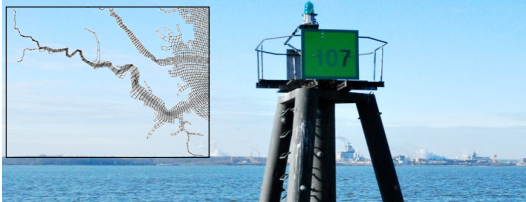
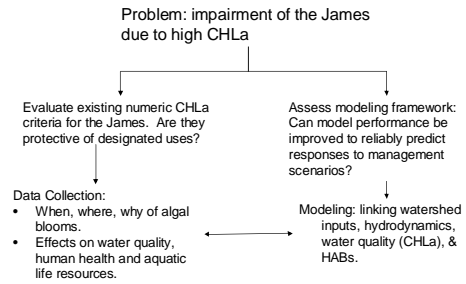


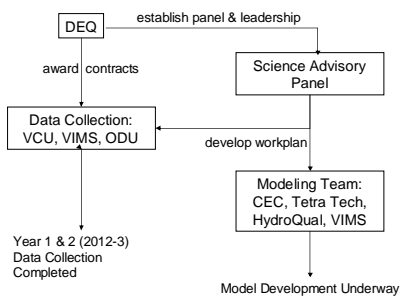
Seventh Science Advisory Panel Meeting for James River CHLa Study April 11, 2014



James River CHLa Study



Project Status



April Meeting of SAP

- Review progress in data collection and modeling activities.
- Discussion Points:
 - Human Health Concerns arising from presence of cyanotoxins in tidal-fresh James
 - DEQ Assessment Procedures: integrating fixed-station and other CHLa data
 - Linking HABs to toxic effects: meta-analysis of literature data



Workplan for Data Collection

Data and Modeling Needs for Assessing Numeric CHLa Criteria of the James River Estuary

prepared for the Virginia Department of Environmental Quality
by the Science Advisory Panel

The data needs were organized under two broad objectives: (1) characterizing the spatial and temporal extent of algal blooms, and (2) identifying and quantifying impairments to designated uses associated with algal blooms. The first objective entails data collection to characterize the blooms themselves (frequency, duration, intensity) as well as supplementary data and studies to understand environmental conditions that favor their occurrence.

Subtask 1.1—Characterizing spatial & temporal patterns of algal blooms

Tidal-fresh

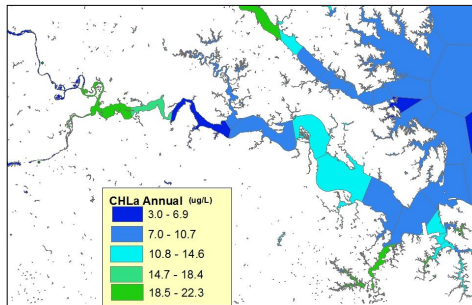
- Weekly monitoring of CHLa, phytoplankton and microcystin at DEQ-CBP stations
- Continuous monitoring of CHLa and phycocyanin at one site (near JMS75)

Oligo-, meso- and poly- haline James

- Expansion of dataflow cruises to oligohaline
- Event-based sampling of CHLa, nutrients and phytoplankton in Lafayette River
- Continuous monitoring in lower James (JMS18) and two sites in the Lafayette

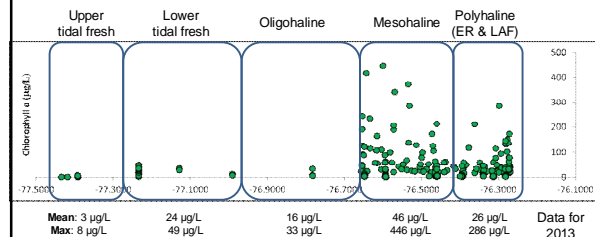
Monitoring activities conducted in partnership with City of Richmond and HRSD

Subtask 1.1—Characterizing spatial & temporal patterns of algal blooms



Map of CHLa based on annual average values for monthly fixed-station monitoring (2005-10).

Subtask 1.1—Characterizing spatial & temporal patterns of algal blooms



Implications for CHLa standards: Are existing standards based on monthly fixed-station monitoring protective? How do we incorporate results from continuous monitoring into assessment procedures?



Subtask 1.2— Environmental factors favoring algal blooms (tidal fresh)

"Three areas of data needs were identified by the group as necessary for understanding bloom formation and supporting modeling efforts to assess CHLa attainability.

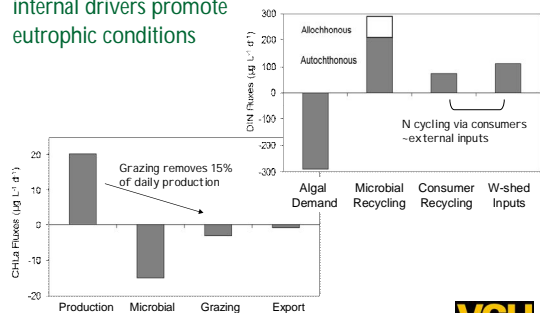
The first of these concerns factors that regulate phytoplankton growth, and specifically, the forms of nutrients that sustain algal blooms."

A second issue to be addressed is the role of consumers in regulating algal abundance in the tidal freshwater James.

Lastly, the panel recognized the importance of understanding not only the general causes of algal blooms but specifically those factors that favor the occurrence of harmful algal blooms, in this case, cyanobacteria."

*see Wood and Bukaveckas 2014 Estuaries & Coasts

Top-down Effects: internal drivers promote eutrophic conditions



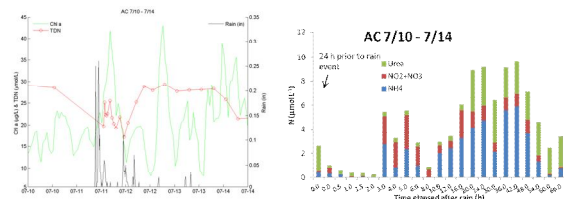
Data are mean daily values for March-November 2012-13.

Subtask 1.2— Environmental factors favoring algal blooms (lower James)

"Algal blooms occurring in the Lower James River Estuary are ephemeral in nature and unpredictable in their timing, location and duration. Algae have the capacity to bloom quickly and to be transported by currents. As a result, sites of bloom initiation may be geographically distinct from areas where blooms develop and cause detrimental effects on water quality and living resources.

Research to date indicates that runoff associated with localized storm events delivers nutrient pulses to the Lower James River Estuary. These events may be important to triggering bloom initiation. Additional studies are needed to measure nutrient pulses in the James associated with storm events and to link their occurrence with results from CHLa monitoring efforts."

Event Sampling in Lafayette River



- July 11th, rain = 1.3 in
- Elevated CHLa and reduced dissolved N after event
- Inorganic N and urea depleted in first 3 hours during CHLa increase

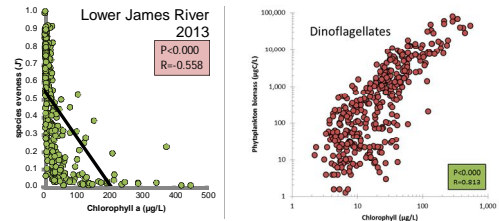


Objective 2. Characterizing Impairments Associated with Algal Blooms

"The Panel's consideration of impairments arising from algal blooms focuses largely on occurrence of harmful algae and particularly those that produce toxins. The Panel felt that a key issue in assessing impairments was to identify and quantify the loss of resources, inclusive of water quality as well as living resources.

In addition to monitoring of toxins in water, sediment and tissues, the Panel recommends that an assessment of impairment should include experimental data to directly link toxin exposure to deleterious effects on species that are important components of the James food web. These data would provide an empirical basis for justifying standards, either for toxin concentrations directly, or for proxy indicators (e.g., CHLa, cell densities)."

Objective 2. Characterizing Impairments: changes in community structure



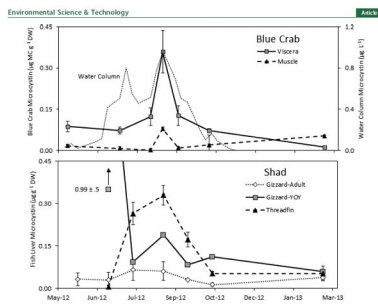
Declines in diversity of phytoplankton communities with increasing CHLa due to dominance by dinoflagellates.



Effects on Living Resources

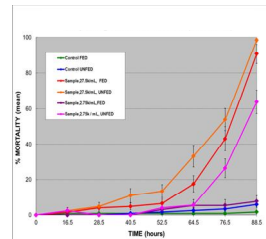
Microcystin present in a wide range of consumers in tidal fresh.

Impacts on living resources (mortality, reproduction)?
Concerns for human exposure?



Wood et al. 2014 ES&T

Effects of Harmful Algal Blooms on Living Resources: Toxicity Testing



- *Artemia* exposed to *Cochlodinium* collected from the James River on 17 July, 2012
- Cell density = 27,500 cells/ml
- CHLa: 352 µg/L

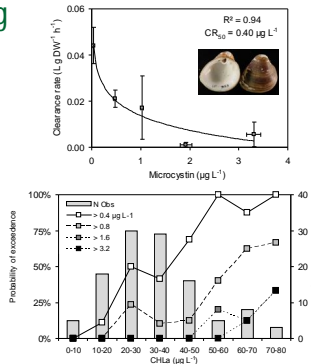
What is the frequency of occurrence of toxic conditions in the environment?



Effects on Living Resources

Top: effects of exposure to dissolved Microcystin on clearance rates of Rangia.

Bottom: likelihood of exceeding Microcystin concentrations at various levels of CHLa.



Today's Meeting

- 10:00 am Opening Remarks by Paul Bukaveckas
- 10:15 Synthesis of 2013 Results by P. Bukaveckas
- 10:45 Panel Discussion of 2013 Monitoring Results
- 11:00 Synthesis of Modeling Activities by D. Jasinski
- 11:30 Panel Discussion of Modeling Activities
- 11:45 Lunch Break
- 12:30 Human Health Concerns: Alex Barron (DEQ) & Rebecca LePrelle (VDH)
- 1:00 Panel Discussion of MC and Human Health Concerns
- 1:15 CHLa Assessment Procedures by Arthur Butt & Tish Robertson (DEQ)
- 1:45 Panel Discussion of CHLa Assessment
- 2:15 Meta-analysis of HAB Effects on Living Resources (Anne Schlegel)
- 2:45 Panel Discussion of HAB Meta-analysis
- 3:15 Wrap-Up & Adjourn Meeting

